

DIMENSIONS

MAGAZINE

For students.

By students.

EDITION ONE ● OCTOBER 2020



NEHA GUPTA

CO-FOUNDER ADDRESS

To whomever this reaches, I hope this reaches you well.

Like everything, Dimensions Magazine started out as an idea and a product of curiosity. From the first lofty discussion to the process of putting words on paper to where we are now, the legwork towards making this magazine never felt like work. But now, two months ahead of when Dimensions was just an idea, Catherine and I are ecstatic to launch our first edition of Dimensions Magazine.

Creating a wider platform for others to learn about and contribute to the ever-growing world of science has felt purposeful in every stride. This magazine is the result of our passion for science and will play a role in the building of a better community; I couldn't be happier. In this first edition, there are many people to thank: our dedicated editors, our online community, supportive friends and family, and of course you, the reader. I hope that as you read through this magazine, you can walk away with more knowledge and purpose.

CATHERINE MULCASTER

CO-FOUNDER ADDRESS

It's baffling to think about how far just a single thought can take you.

Dimensions Magazine started as a strange and quite random idea. I didn't think too much of it at first, if I'm completely honest. I still can't believe I'm writing this now. As a highschooler who loves STEM, starting Dimensions Magazine was like adopting a puppy. It has been fun, exciting, unexpected, scary, but mostly fun. I am so beyond excited to share this magazine with the world and to showcase the hard work of our wonderful editing team and my fantastic co-founder Neha. I feel so lucky to be able to present to you the beautiful articles written by the public as well as our own editors. As Neha and I continue to tend to this quickly growing community, I really can't help but express my gratitude and grin with anticipation for our next edition of Dimensions Magazine.

MORE THAN JUST A MAGAZINE

On Instagram: @dimensionsmagazine

Find us at our website: <https://dimensionsmagazine.weebly.com>

Reach out to us by email: mag.dimensions@gmail.com

STUDENT LIFE

WAIT, THIS IS A CAREER IN STEM?

Saan John

STEM is much broader than you might have thought.

Believe it or not, there are many “untraditional” career paths in STEM that many people probably not aware of. When pondering whether this is the “correct” career cluster, many students may be wrongly turned away from understanding what STEM has to offer. The wide diversity in this cluster which uniquely combines different people’s passion with technical or scientific aspects is, unfortunately, what many don’t realize. So here is some information on three non-traditional career paths in STEM that just might spark some interest:

A Cryptozoologist

Are you a fan of unknown sightings on the mystical creatures that seem to only exist in fictional worlds? This is the perfect fit for you! This career is filled with scientists that find unknown species, known as cryptids. Not only that, but there

are opportunities to travel around the world as well in order to find these creatures. Scientific methods must be used in the finding and tracking of these creatures, which is why a degree in zoology or biology is required for this field. Physical evidence such as footprints and hair are analyzed and reports are written based on the observations/evidence. Cryptozoologists play a huge role in the identification of different species to determine what species exist and shape the way we study living organisms.

A Snake Milker

This career is for those who really strive for a more dangerous work environment, like dealing with snakes on a regular basis. Snake milkers “milk” the venom from poisonous snakes so that researchers can produce more pharmaceutical drugs. The snake is tricked into releasing venom as there is rubber used to simulate prey. Workers need



Snake Milking is not for the faint-of-heart. Credits to Future Goals and Plans [<https://bit.ly/2HP1IJB>]



STUDENTS MAY BE WRONGLY TURNED AWAY FROM UNDERSTANDING WHAT STEM HAS TO OFFER



all degrees of herpetology or biology to qualify, so the career is quite rigorous! Treatments produced through snake venom can be used towards blood clots, Alzheimer's disease and high blood pressure. Antivenom is also produced to fight against venom poisoning in the body. This occupation requires much bravery, as it is not uncommon for these milkers to get mild bites by the snakes. But while they may be risking their lives, they could also be saving many other lives.

Fashion Designer

Step in the shoes of famous designers like Coco Chanel and be the next trend-setter! Here, you can use your mathematical geometry skills to create different patterns and styles. It is also useful for measuring different fabrics and replicating 2D sketches to 3D models. In the rapidly changing fashion industry, one must be able to identify and keep up with the latest trends. Using technologies that can provide a better custom fit for customers, the industry is one filled with rapidly increasing opportunities. Fashion is also heavily influenced by consumer demand, and is why only the most skilled business entrepreneurs become successful designers. Degrees that need to be obtained could include Fashion Design, Interior Design and Fine Arts. However, STEM is slowly being introduced into this field through design technologies and

and different creations.

The list of STEM-related careers continues, with possibilities like becoming an Aquarist, Fragrance Chemist and Flavour Technologist. We tend to limit STEM to its most known subcategories, but there is much more to science than the first stereotypical impression. There is endless potential one to be achieved, which is why it is crucial to keep an open mind of what career you would like to pursue in the future. The benefit of these types of jobs is that there can be more employment opportunities, since they aren't as popular. Regardless, each person is different and we are all uniquely suited to our own occupation. It's time to embrace the wide diversity of pathways in STEM as a community which needs to be appreciated! So perhaps, maybe science is the correct career cluster for you.... just not the way you imagined it.

SCIENCE

PLASTICITY: THE BRAIN'S SHAPESHIFTING SUPERPOWER

Catherine Mulcaster

Yes, you heard me correctly, the brain can in-fact shape shift.

In fact, throughout your life your brain has undergone many changes and continues to change to this day. From how your neurons fire, to entire neurological communication networks, there really is no limit to how much your brain can shape-shift.

But when talking about the brain, what does it mean to shape-shift?

We're referring to something neuroscientists call plasticity. We're not talking about your brain moulding itself into any shape by will, shape-shifting or plasticity refers to smaller and more gradual changes of neurons of how and where they fire their electrochemical signals.

Let's break it down:

For starters, a neuron is a type of cell within the nervous system that integrates and sends electrochemical signals to and from other cells.

Neurons communicate with each other by using chemical messengers.

These chemical messengers are produced because of electrical signals and can in turn produce electrical signals called action potentials.

The space in which these chemical messengers are exchanged within the brain is called a synapse, a microscopic gap of 20-40 nanometers (nm) wide, between two neurons. The exchange of different chemical messengers triggers different neurological responses. Glutamate, in this case, is responsible for neurological shape-shifting. On the opposite neuron, there are several glutamate receptors. These receptors accept and react to glutamate when it

reaches the postsynaptic terminal. As the British Neuroscience Association (n.d.) states, "AMPA receptors are the fastest into the act." (pp. 27-28).

NMDA receptors, however, are what trigger the neuron's shape-shifting abilities. When little glutamate is introduced into the synapse, the NMDA receptors play little role in integrating the chemical signal. This is because when the receptors are open, they become plugged by the ion, Mg^{2+} . When they are plugged, no glutamate can activate these receptors and thus do not activate.

When a synapse is activated quickly, meaning that there is a large quantity of glutamate in the cell, a depolarization in this side of the synapse occurs. This causes the Mg^{2+} to rush out of the NMDA receptor.

As a result of the greater influx of glutamate, the NMDA receptor opens. With the NMDA receptor depolarized, Na^+ , K^+ and Ca^{2+} rush into the neuron. Ca^{2+} is

crucial as it can trigger the introduction of new AMPA receptors into the cell and can increase the efficiency of the existing AMPA receptors. Not only that, the influx of Ca^{2+} into the neuron causes a “gene transcription for the creation of new synapses in a process called synaptogenesis” (Rossouw n.d)

In summary:

Large influxes of the chemical messenger, glutamate into a synapse can result in changes within post-synaptic neurons such as an increase in AMPA receptors, which can improve neural connectivity and strength and can even cause the creation of new synapses within the brain.

Even more in summary:

The more a neuron fires into a synapse, the stronger that connection gets.

Or as neuroscientists like to say:
“Neurons that fire together, wire together”



PLASTICITY REFERS TO SMALLER AND MORE GRADUAL CHANGES OF NEURONS.



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SCIENCE

LUPUS

Neha Ramana

There is still no cure for lupus, a disease effecting millions across the world.

Lupus is an autoimmune disease meaning that the body's immune system attacks healthy tissues instead of infections. It is a long-term disease that can cause inflammation commonly on the skin, joints, and internal organs but can affect any part of the body. Some of the symptoms include pain, fatigue, hair loss, physical impairment, swelling in face and feet, sensitivity to light, and chest pain.

The Lupus Foundation of America estimates that “about 1.5 million Americans and 5 million people worldwide have a form of lupus.” This disease is not contagious and mostly affects women in their childbearing age. 9 out of 10 women live with Lupus between the ages of 15-44.

There are four different forms of lupus: systemic, cutaneous, drug-induced, and neonatal.

Systemic lupus, the most common type, accounts for about 70% of lupus cases. The brain, kidneys, lungs, and heart are commonly the most affected organs. Cutaneous lupus only affects the skin and accounts for about 10% of lupus cases. Drug-induced lupus, also accounting for 10% of lupus cases, is caused by high doses of certain medications. The symptoms of drug-induced lupus are similar to that of systemic lupus, but they usually subside when the lupus inducing drug is discontinued. Neonatal lupus is a rare condition where the mother's antibodies affect the fetus. The baby may be born with skin rash, liver problems, or low blood cell counts, but the symptoms eventually disappear after six months.

Lupus is caused by a combination of genetics and environmental factors. In most cases, the causes of lupus

are unknown. Due to this, numerous tests are needed to identify and detect lupus. Doctors may use multiple parameters to diagnose the disease such as medical history, family history, physical exam, urine and blood tests, and skin or kidney biopsy.

Unfortunately, there is no cure for lupus, but there are treatments to help alleviate the symptoms and prevent the flares. Commonly used medicines include nonsteroidal anti-inflammatory drugs (NSAIDs) like ibuprofen, corticosteroids, antimalarial drugs, chemotherapy for severe cases, and BlyS-specific inhibitors.



Selena Gomez's battle with Lupus. Credits to Healthline
[<https://bit.ly/3mGu7Lw>]

Due to the advancements in technology and medicine, people diagnosed with lupus are now able to live longer and healthier lives. The two leading causes of death in people diagnosed with Lupus are kidney disease and infections. Lupus gained public attention in 2015 after singer Selena Gomez announced her diagnosis on Instagram. She also documented the kidney transplant she had to undergo because of the disease.



5 MILLION PEOPLE WORLDWIDE HAVE A FORM OF LUPUS



Famous celebrities who have been diagnosed with this disease include Selena Gomez, Nick Cannon, Lady Gaga, Seal, Paula Abdul, Toni Braxton, and Kristen Johnston. Having public figures such as these diagnosed with lupus can hopefully spread awareness for the possibility of innovation in this field.

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STUDENT LIFE

SCIENCE IS OUR WAY FORWARD

Neha Gupta

STEM is our way out of the Coronavirus Pandemic.

Science has always played a fundamental role in our everyday lives, but its value has truly been appreciated in the past few months. With nowhere else to turn but science in handling the coronavirus, scientists have their work cut out for them.

Until the Coronavirus pandemic, I hadn't seriously considered the effects science has on man-kind's everyday. For me the absence of science would leave a considerable hole or gap in my life because of my affinity with the subject. But I never wondered how other's found a way to appreciate science until the pandemic. Guidelines, safety protocols, decisions, progress; these are all being given to us by science. Now, it seems we have all become linked to science in one way or another. After all, it is working to minimize our risk of getting sick, is trying to keep us safe, and is

working to save lives. That's a pretty tremendous feat for science. Aside from the pandemic, science has always played its part in the world. Without the Coronavirus, the scientific community has been working to push the borders of our knowledge. From images of black hole to the revealing of a computer-chip inside a pig's brain, discoveries are being made everyday (they rarely make headlines, which is a given since there are too many discoveries)

Ongoing research, the desire for answers and a commitment to results like this can drive the world forward. An example of these attributes at work can be found in antibiotic resistance research. During study, scientists found that certain specimens of bacteria release "toxins that disarm the mitochondria of immune cells". This process inevitably leads to apoptosis, or the dying of the cell. A team of scientists



The Coronavirus Pandemic has turned our world upside down. Credits to Health Affairs [<https://bit.ly/34KfP6A>]

at Monash Biomedicine Discovery Institute are leading the way to target the automated cell response of apoptosis to increase the ability of the body to fight infectious bacteria. Although three specimens of bacteria were tested in the studies, the potential for this technology to be implemented towards other pathogens is promising.

In the world of space exploration, astronauts recently launched a mission to search for ancient life on Mars. The Mars rover Perseverance was launched on July 30th 2020, and is estimated to arrive on Mars on February 18th, 2021 to begin its search. Following two of the most

longstanding Mars' exploration missions, Perseverance will hopefully provide data that will help us better understand Mars' current and previous climate, give evidence of previous life forms on the planet and its composition. The twin rovers Opportunity and Spirit, who launched in 2003, were able to collect significant evidence pointing to previous water bodies and habitable land.

And how could we pour over strides in the scientific community without mentioning the world's work to develop a Coronavirus vaccine in the past six months? More than 170 teams of researchers are racing to develop an effective and safe vaccine to prevent the longevity of the Coronavirus pandemic, lockdown and its effects. As of today, this global effort is a landmark for being the fastest effort to create such a drug in human history. With eleven potential drugs in Phase Three of

clinical trials, the chance that a successful vaccine is found is bringing optimism in a time of fear.

In science, we are left to rely upon skill, patience, hope and time to see results. Although it is quick to note the discoveries in science we have seen in the past year, the face of the discovery masks the months or years worth of work that it took to achieve that goal. However, when the world looks back on the Coronavirus pandemic years in the future and how we combatted it: through science.

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WASH YOUR HANDS, SOCIALLY DISTANCE, WEAR A MASK.

#StopTheSpread

Use soap
and water
for at least
20 seconds



Maintain a
distance of
2 meters
from others

Wear either a **medical or
non-medical** mask

DIMENSIONS MAGAZINE TEAM

Founders

Catherine Mulcaster

Neha Gupta

Editors

Athena Apaga

Halona Augustine

Megan Foster

Sissi Guo

Kyla Kiunisala



Thank you!